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THE CURRENT STATE AND PROBLEMS OF CZECHOSLOVAK MEDICAL BIOMETEOROLOGY

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/(Note) - This report was presented at the First Working Conference of the Bioclimatological Group of the Czechoslovak Meteorological Society of the Czechoslovak Academy of Sciences, held on 13 September 1959 in Plzen./

The purpose of this report is to evaluate the individual phases of research in medical biometeorology, to state its current state, and to sketch roughly the further development of this discipline.

The question before us is whether the current state of Czechoslovak biometeorology is on a par with the level and orientation of this field abroad. We shall also try to recapitulate some of the basic historical data.

Medical biometeorology was brought to its solid scientific foundation by the basic works of Bernard de Rudder in the thirties of the century. He summed up the information since the oldest times and arrived at many conclusions, the majority of which are still in use today. The period before him was characterized by partial communications from individual authors of the most varied branches of medicine who were led into experimentation mostly through their own empiricism. Shortly after de Rudder laid the cornerstone of medical biometeorology, there appeared a number of scientists experimenting primarily with the biometeorological relations, without any mutual contact or broader perspective. During the Second World War the majority of these people, doctors of biometeorology together with interested people from other, non-medical fields, gave rise to the so-called medico-meteorological centers, located primarily in Germany. We are thinking of the Hamburg group led by Prof Schroeder, the Tuebingen laboratory of Engineer Daubert, Koenigstein's Dr Becker, Prof Lossnitzer's Freiburg Center, and the Bad Toelz Laboratory, led by Prof Ungeheur. These centers document the close co-operation between the medically trained meteorologists and the meteorologically thinking doctors. The centers of their interest is the complex evaluation of meteorological phenomena, their accurate and minute analysis, the use of bioclimatograms, laboratory work, and the utilization of some of their findings in the practice of medicine through the help of biometeorological predictions.

In Czechoslovakia biometeorology had the same development. Before the Second World War there were isolated individuals who worked on this problem, led by the experiences gained from medical practice; among them were Hubacek, Heubnar, Baces, Hosek, Jansky, Hajek, and others. J. Brychta attempted a more complex explanation based on B. de Rudder's experiences in collaboration with the brilliant German meteorologist F. Link. For this purpose Brychta established a bioclimatological observatory in Hradek Kralove that was oriented toward a meteorological experimentation with all elements. After 1945 there were further sporadic reports from the various meteorological branches, such as, the work of K. Bobek, R. Riedl, M. Polorny, J. Pojer, S. Svorcova, J. Mestan, M. Pastrnak, J. Gleich and V. Maly, and others.

There was also a rise of organized groups directed toward a particular area of research, using various methods and means. We have in mind primarily the biometeorological group of Dr. Symon's Hygienic Institute in Prague and our Plzen biometeorological group. J. Novak from Prof Gawalovsky's First Dermato-venerological Clinic in Prague also shows some systematic work. V. Struzka had already referred to the problems and tasks of biometeorology, bioclimatology, and spa meteorology at the First National Meteorological Conference in 1952. In 1953 at the Second National Meteorological Conference, J. Brychta presented a similar report on the "Current State of Bioclimatology in Our Country; Suggestions for an Improvement of its Method of Scientific Research". A significant step toward the establishment of co-operation and an exchange of experiences between Czechoslovak and foreign specialists in biometeorology was taken by the International Society for Bioclimatology and Biometeorology in 1956; its ranks were joined by members of the individual laboratories in our country. The first exchanges between meteorologists took place at the First and Second National Bioclimatological Conferences held in 1955 and 1958 in Liblice. The last one was already attended by meteorologists from the people's democratic countries along with the Secretary of the International Society for Bioclimatology and Biometeorology. Along with the Bioclimatological Committee of the Czechoslovak Academy of Sciences which has been in operation for several years already, the newly created Czechoslovak Meteorological Society had established a special bioclimatological group in 1959. Academician V. Novak and others have made significant contributions to the First Bioclimatological Congress in Vienna in September, 1957; co-operation with Soviet bioclimatologists and biometeorologists was established by Prof Dr K. Bobek, who attented the First Climatopathological All-Union Conference in Moscow in March, 1959.

From the above-mentioned data it is evident that the basis for international co-operation of biometeorologists has been made. So far, however, there appears to be no unity of effort and planning of the further development of medical biometeorology among individual workers and laboratories in Czechoslovakia. The First Conference held in Plzen on 13 November 1959 tried to co-ordinate further research, and thus ttry to improve the quality of the work and establish a progressive development of biometeorology in our country.

In general we can say that medical biometeorological research runs in three phases. In the first phase, the present empirical knowledge from the various branches of meteoropathology are evaluated on a mathematical-statistical basis. On the basis of the data compiled from the first phase of research, we reach a further phase where analytic experimentation shows the meteorological, cosmic, and other factors which actually affect a human organism in sickness and health, and explains the mechanisms of their influence on man. Only on the basis of this research and the synthesis of the knowledge thus gained, can we actually reach a practical utilization of this data in modern medicine, whether it be through preventive measures, the cure of the sick person, or its use on healthy individuals. It seems that in our country the research has already gone through this basic phase, and our workers in this field are faced with the problems of analytical research in the second phase, which is most necessary for a practical use of biometeorology. In our country, therefore, research has the same tendencies as abroad, but lags a bit in time because thus far there is insufficient collaboration.

In looking at the first phase of research, one finds that not even this phase of development is completely finished. This is only because the conclusions of individual efforts are often inconsistent and, therefore, difficult to compare. It seems that this inconsistence is caused by the use of different methods. Therefore, we suggest that the individuals working in biometeorology use a statistical evaluation of data and maintain correct clinical, meteorological, and statistical criteria. The question arises whether it is necessary for us to concern ourselves with these problems when we are already at the second, analytical phase of research, and have numeroud publications from abroad at our disposal. This objection cannot stand, simply because it is very difficult to compare our climate to the climate of other countries. So far, these climatic differences could be neither dismissed nor confirmed, because every one of our laboratories uses different methods.

The method of clinical selection or the selection of healthy individuals. We consider it absolutely necessary (of course, in retrospect it is impossible) to separate the sick and healthy into meteoro-stable individuals and meteoro-liable ones; it is necessary to find and work out a method that would serve to determine their susceptibility to the weather. In chosing people for observation we think it is important to work only with sick individuals whose diagnosis is firmly established and possibly confirmed by a whole section. The selection should not include individuals whose diagnosis shows a variety of diseases. They should be further separated into "treated" and "untreated," and eventually separated according to the manner of their treatment. The patients treated by balneotherapy should be observed separately, because the reactibility of these patients is not only affected by climatic factors, but there are also the after-effects of administering medication. It would seem pertinent to compare the biometeorological observations, not only from different climatic regions but also from the various areas of our state, according to the geographic occurrence of a particular disease. During every occurrence of a disease or a biological phenomenon, it is necessary to establish the exact beginning of the change, i.e., the beginning of the illness, changes in health, and

changes in reaction, computed to the nearest hour. It is also necessary to work consistently for a number of consecutive years, and thus eliminate the periodicity of biological rhythms. Every observation should be made in collaboration with a control group.

The meteorological method. According to the most recent points of view on meteorological research, one should not work only with the basic meteorological principles of atmospheric fronts and air masses, but undertake a more detailed analysis of dynamic changes of the atmosphere in an intricate comparison of all the related factors. This has been pointed out by the biometeorological centers, Prof Becker, and engineer Daubert. It requires a persistent observation of meteorological activity for hours at a time. For example, Ungeheuer's division of the weather into six phases is a proper division of weather movements which can be very easily corrolated with biological activity. The analysis should go on both throughout the whole year, as well as during the individual seasons. Besides meteorological factors, cosmic and solar factors should also be taken into consideration. From the cosmic factors, one should point out the influence of cosmic radiation. Solar activity can be measured by the vastness and frequency of solar eruptions caused by an increase of electromagnetic and corpuscular radiation and the disruptions of earth's magnetism. Attention should be also paid to the various other kinds of radiation, such as the so-called high frequency long wave radiation, the electric condition of the atmosphere (especially the electric gradient), the conductivity of the atmosphere, the frequency, scope, movement, and charge of electric ions, and further research on the oxidation and reductive qualities of the atmosphere, such as ozone. Thus far, in observing the meteorotropism of some diseased conditions, we ourselves have used the basic meteorological principles, such as, barometric pressure, heat, and relative atmospheric humidity. At the same time, our primary concern was with their tendencies in a particular period of time, taking into account the particular time of the year; however, we did not make our evaluations on the basis of speed and the speeding up of the various changes, as Engineer Picko suggests in his works. In an effort to use the most complex activity possible in our corrolations, in the following phase of research we have abandoned the search for individual elements and turned our attention to the movement of fronts. We recommend that frontal movements be observed with an accuracy to the nearest hour for a particular place of observation, and that the particular time of year be kept in mind. The observation of fronts, however, falls into the above-mentioned category of critical requirements. To determine solar activity, we first used the relative number of sun spots (the so-called R number of solar activity of Prof Dr Waldmeier); this data can then be used in observing phenomena in individual years. For a more detailed analysis in a time-span shorter than half a year, we recommend (in agreement with the members of the Czechoslovak Academy of Sciences's Astronomical Institute in Ondrejov) the use of chromospheric eruption values. Our own experiences show that the strength of eruptions during the minimum phase of solar activity has a different value than the maximum phase, and vice-versa.

The statistical method. The literature in this field recommends statistical evaluations of the criteria under observation by using the

so-called metoeorotropic index of de Rudder, Gauss's integral of probability, Schnelling's t-test, Pearson's chi quadrant method, and the N-method. The literature on the subject and our own experiences show that if the number of tasted biological phenomena is smaller and is represented on a smaller scale, in the last-named statistical method it is advisable to consider the day or the hour of the appearance of the biological or pathological phenomenon as the N-value. In observing a regularly appearing phenomenon, the meteorological activity should be related to the N-value. The use of the N-method in hours over a period of 144 hours is considered to be the best method, and only in some cases where there is a lack of a time division, over a seven-day period. In observing the effect of solar phenomena, the span may be greater, and spread over a ten-day period or even more.

In a statement of these basic methods it can be seen that the observation of biometeorological phenomena on the basis of mathematical-statistical retrospective values is far from being finished throughout the whole phase. It will be necessary to corrolate the current data with the modern principles of proper clinical, meteorological, and statistical methods and, at the same time, to broaden the mathematical-statistical method of biometeorological research into further branches of medicine, such as, ophtalmology, gynecology, stomatology, and others, and to include the observation of healthy organisms.

One should keep in mind that the current knowledge of meteoropathology and meteorophysiology obtained by the mathematical-statistical research methods can never be utilized without the knowledge of meteorological mechanisms and other factors. The only possible methods of research are experimentations and laboratory work using more perfected and more modern technical machinery. Abroad, the biometeorological research is already going through this phase; much information was already published in this field.

In our circumstances we see the necessity to establish and organize research areas as soon as possible and provide them with proper equipment and personnel. Therefore, we need not only one central laboratory, but several that would work on the same problem at the same time, then compare their results. Some clinical laboratory research; for example, the Plzen Clinic of Internal Medicine has a research laboratory on blood coagulation; Prague has an allergy laboratory and many others that could in the nearest future incorporate special biometeorological study. In addition to clinics, it is, of course, necessary to have physico-meteorological centers with the opportunity to develop new machinery, and with personnel that would be capable of daily and regular co-operation with a clinic and laboratory; such is the case at the Institute of Medical Physics in Plzen. Furthermore, we recommend the establishment of climatic chambers in which the effect of individual atmospheric elements can be freely changed, thus influencing the reactions of human organisms. One must keep in mind that some of the biometeorological results can be successfully used in cosmic medicine, and that this data can be re-applied to the study of biometeorological phenomena. All of these suggestions require certain organizational and economic measures which we suggest, be included in the plans of our bioclimatological group.

Medical biometeorology is far from being just a theoretical field; its further development in the right direction can have beneficial effects on both healthy and sick individuals. Some of the results can already be

used in the very near future. We are thinking of using a change of climate as a possible cure, a wider utilization of some of the findings on the influence of earth's magnetic pole, the use of artificial atmospheric ionization, and artificial climatization in medical and other installations. General experience tells us that certain medicines suppress the patient's sensitivity to the weather. We recommend chloropromicin (largactyl) for the treatmemt of hardening of the arteries, and antimalarica in chronic rheumatic illnesses, and others. Even though we know that at the present time it is impossible to make use of a biometeorological prediction, we nevertheless do not lower its importance, for it can be very well used for the above-mentioned reasons of preventive medicine. We prefer the trial use of predictions for individual health institutions, but not for larger compounds. Biometeorological prediction could be used on healthy people; for example, on professional drivers or on individuals in risky occupations, etc. The use of biometeorological predictions would allow them to concentrate more on their performance and at the same time would support a smaller rate of accidents and injuries. This method of prevention is already being tested abroad. In our circumstances we want to try it on the drivers of vehicles in public transportation and, on the basis of the changes in the reaction period, determine their sensitivity to the weather. Our experiences show that even in legal practice and criminal procedure it is necessary to judge misdemeanors with regard to the particular weather conditions.

From the preceding discussion regarding the further successful research in bioclimatology in our country, the following conclusions have been incorporated in the plans of our specialized group.

Our Plzen laboratory has already made an attempt to work on some of the problems brought forth by the Liblice resolution. Along with our own research in the field of biometeorological relationships in internal medicine, we have established ties with people in other fields; for example, with safety organs. Within the scope of international co-operation, we have gained a great deal by Prof K. Bobek's participation at the First Climatopathological Conference in Moscow in March, 1959, where some of the results of our research were presented and personal exchanges were established. We think it necessary at this time to mention that in the Soviet Union, although there the bioclimatological research began relatively later than in other countries, a lot of attention is being paid to this branch at the present time. The proof of this is the more than 20 reports presented at the Moscow conference from the various parts of the USSR. Our Plzen center has also joined the national research in tromboembolic diseases, also, there are more opportunities for biometeorological research in the area of blood coagulation. Our group has chosen to accumulate the greatest possible number of foreign and domestic publications on medical biometeorology. We have also organized several general scientific lectures, both for the general public and the patients in the Plzen National Health Clinic, and a lecture designed to further the education of our medical personnel. We made contact with the Soviet radio and press, and are also co-operating with the Czechoslovak radio. The medical school in Plzen has devoted two hours of lectures to the teaching of medical physics presenting the basic concepts of medical biometeorology, two hours of lab-

oratory work to the methods of using meteorological instruments, and an introduction to the basic principles of synoptics. Furthermore, the students were offered guided excursions to the meteorological station at the physics institute. There is also an active student scientific circle. Two student scientific circles have already successfully worked on biometeorological problems at the Plzen Clinic of Internal Medicine. They reported on their work at student scientific conferences. At the clinic's medical seminars there are regular yearly evening lectures designed to acquaint the doctor with the current problems of our research. The work of the Plzen Biometeorological Center is made possible by the fact that within the medical school in Plzen, two institutes are working on the same problem; one has a theoretical orientation, and the other, a clinical one. Both have at their disposal on the one hand, the proper mechanical equipment; on the other hand, practical application.

Conclusion.

The individual phases of research in medical biometeorology were evaluated. The current status was reviewed and the further development of this discipline was sketched out roughly. Suggestions for the present clinical, meteorological, and statistical research methods were indicated and the use of some of the results in medical practice was suggested.

10,205

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